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ABSTRACT

Reading is one avenue of learning in the vital curriculum area of science. Factual as well as fictional content can be read by pupils in ongoing science units of study. Both fiction and non-fiction provide for attainment of science curriculum objectives emphasizing knowledge, skills, and attitudes. This document discusses teaching methods that combine science instruction with reading in sections covering individualized reading, h gher levels of cognition, using basal textbooks in science, listening in the science curriculum, speaking activities in science and writing in science. (LZ)

Reading in Science

by

Marlow Ediger

READING IN SCIENCE

Reading in science is one avenue of learning in this vital curriculum area. There are numerous kinds of subject matter for learners to read. Factual as well as fictional content can be read by pupils in ongoing science units of study. Both should provide for enjoyment and encouragement to attain objectives in the science curriculum. Objectives emphasizing knowledge, skills, and altitudes need to be in the offing. Individual differences must be provided for so that fast, average, and slow learners might well achieve more optimally.

Individualized Reading

I recommend strongly that each pupil has adequate time to select and read trade books on an individual basis. Library books related directly to the science unit being taught need to be located at a learning center. The books should be on a variety of achievement levels so that each pupil can choose a book that is his/ her reading level. It is frustrating for the learner if a library book is too complex to read. Should the chosen book be too easy to read in terms of content, boredom may set in and be an end result. Each pupil must experience challenge and interest in reading a self selected library book.

To further provide for individual differences, library books should be on diverse topics, but definitely related to the unit in science being taught presently. Thus, if pupils are studying a unit on "The Changing Surface of the Earth," they need to be able to select books on a variety of titles such as those pertaining to volcanic eruptions, mountain formation, erosion, climate, and earth quakes. With different topics being covered in library books, each pupil may choose what is of most personal interest. Interest is a powerful factor in motivating pupil achievement. Pupils, when selecting their own library books, read to follow their very own purposes. Possessing perceived purpose also is a motivational force in guiding optimal progress in science achievement. I believe pupils tend to perceive increased purpose or reasons for reading when self selection of materials is involved rather than the teacher

choosing what learners are to read. The content acquired by pupils from reading should be discussed within the unit title emphasized in a contextual setting, not in isolation from other experiences in the current unit being studied in science. For example, if pupils are discussing the causes of earthquakes, what has been read from library books on that topic may be applied in problem solving situations. Or, if learners are studying the causes of volcanic eruptions, reading of subject matter from library books may confirm or modify what occurred in a related science experiment. Interest, purpose, and relating of content acquired are powerful ways of having pupils achieve, learn, and grow in the science curriculum. This is also true when pupils read or experience other kinds of learning opportunities in science. Each pupil reveals different characteristics from others in the classroom and needs personal attention to these individual factors and traits.

With self selection of reading materials directly related to the present science unit being taught, individual differences in interests and reading levels can be provided for.

Higher Levels of Cognition

The science teacher needs to guide pupils to attain well in higher levels of cognitive domain objectives. Thus, in reading science content, learners must learn to read for different reasons or purposes. Too frequently, pupils have read subject matter to acquire facts. Relevant facts can be salient and important for learner acquisition. Pupils should have ample opportunities to reflect upon factual content read. Thus if pupils have read how sedimentary rocks are formed, they should think about the involved facts. Merely memorizing what has been read makes for a lack of meaning. Questions raised by the teacher and involved pupils about facts read can stimulate thought. Perhaps, the acquired facts can reveal comprehension by using these ideas in new situations. Facts gained then about the formation of sedimentary rocks can be applied to the uses made of this kind of rock in society, such as in building barbecue pits or natural rock walkways and fences. When pupils read, they should be able to apply or use what has been learned.

When pupils read critically, as an even higher level of cognition, they separate one category of information from another, facts from opinions, fantasy from reality, and accurate form inaccurate content. Thus when learners read about rock formation, they should be able to distinguish the forming of sedimentary from igneous rock, or sedimentary from metamorphic rock. Clarity of ideas is vital when learners categorize knowledge. There are numerous opinions that individuals have about science phenomenon. However, science and its content prizes accuracy of subject matter content acquired. Objectivity is a key concept in studying scientific information. An independent environment outside of the observer's perception is in evidence. Thus content in science is objective regardless of who does the observing. To be might well be to be perceived by someone, but there is an independent reality which does not require an observer. Subjectivity in subject matter knowledge is then not a part of the knowledge and skills in science. It is true that our knowledge of science changes, such as the ringlets now accepted as being true in the planet Saturn, not the solid core of rings around this planet as was formerly thought to be the case. However, with modern techniques of acquiring information in the world of science, new facts change ideas about scientific knowledge. This is due to improved scientific methods of securing information, not due to changes in the rings around the planet Saturn, unless the changes are due to scientific (objective) data. For example, the surface of the planet earth changes due to volcanic eruptions, earthquakes, and erosion, among other factors. So too, many other planets change in time, such as Saturn.

Creative reading is another salient kind of comprehension in science. Creativity here stresses a desire by the learner to fill gaps in information in the ongoing science unit of study being emphasized. A gap represents what the pupil does not know and would like to fill in the necessary content. Reading is one approach of doing this. Curious learners who lack information at a given point may do more reading to fulfill that gap. The science teacher should assist learners to identify what they do not understand. Learning opportunities guide pupils to fill

the gap or the unknown. A creative mind can lead to the next kind of reading comprehension and that being to emphasize problem solving. Pupils should be assisted by the teacher to identify problem areas. These problem areas become broad questions, framed so they allow pupils to secure needed content for answers. A variety of learning opportunities may be used to obtain answers. Reading, experimentation, demonstrations, audiovisual materials, excursions, and discussions are and can be used as learning opportunities to secure information in answer to identified problem areas. Pupils with teacher guidance may select problem areas well as resources to use to obtain answers. Next in problem solving, pupils should develop a hypothesis or answer to the problem. I recommend a brain storming approach here. No value judgments should be made as each pupil provides a hypothesis. The hypotheses may be printed on the chalk board as presented to avoid duplication of answers given by learners. The purpose of brain storming is to generate answers. Hypotheses can be tested through experimentation, further reading, use of audio- visual aids, and presentations by qualified resource persons, among other worthwhile procedures. Hypotheses may then need to be revised, if evidence warrants.

There are additional purposes for pupils in reading science content. Thus reading to follow directions can be salient. Individuals in ongoing units of study and in society read directions. These directions must be understood so that they can be followed correctly. Scanning of content is another important purpose in reading content in science. With scanning, the pupil quickly secures an overview of a page or chapter to notice if it contains the necessary information being looked for to solve problems. If so, the pupil may wish to read the rest of the printed ideas. It does save time when a pupil can scan materials to notice if the rest of the ideas need to be read so that relevant content is secured.

When pupils read to secure a main idea or a generalization, facts will support or refute the accuracy of these broad statements. Thus reading to secure a main idea or a generalization is vital. Facts are relatively easy to forget whereas the broader statements (main ideas or

generalizations) are much easier to recall since they are fewer in number as compared to detailed factual content..

Use of Basal Textbook in Science

Basal textbooks, carefully selected, related directly to ongoing units of study can assist pupils to obtain necessary information. The textbook used should be on the reading level of the involved learner so that he/she attaches meaning to what is being read. If the text is too difficult to read orally or silently, the pupil will not understand the contents read. If the text is too easy, boredom may set in for learning on the part of the pupil. The science teacher must observe each pupil to determine if the latter is learning and achieving from the reading experience. Most pupils reveal comprehension from reading if they can answer questions during a discussion covering content of what has been read. However, a few pupils may be shy and not participate in the discussion even though they can read its contents with understanding. Here the teacher needs to encourage all in the classroom to participate. Each pupil needs to attain optimally from reading.

Readines for reading is important. There is much the science teacher can do to guide pupils to achieve well when reading, even though the content may be slightly difficult for the reader. The teacher then should print in neat manuscript letters words that might cause problems in identification for pupils when reading. These words can be printed in isolation or within a contextual situation in sentences. In the latter case, each possible new word needs to be underlined or highlighted. The teacher should then guide pupils to pronounce each new word correctly as listed on the chalkboard. Learners should also understand the meaning of each word either through a brief definition or through use in a sentence. The Glossary located in back of the basal can assist pupils in securing definitions for new words. Pupils need to possess adequate background information in order to attach meaning to what will be read in the reading assignment. If pupils are to read abut volcanic eruptions, they should have the needed prerequisite content to understand what is being read. A purpose or reason for reading needs

to be stressed. The purpose can be in question form from the teacher and better yet from learners themselves. Pupils should then be ready to read so that information in answer to these questions can be gathered.

The follow up to the actual reading activity is a must. Interest in reading and the follow up is extremely important. The following are suggested as follow up experiences for learners:

1. discussing what has been read such as answering the questions in the purpose.
2. outlining selected ideas from the reading selection.
3. summarizing major subject matter read by listing main ideas.
4. drawing a series of illustrations to reveal understandings gained.
5. dramatizing ideas acquired.
6. using attained ideas to solve problems or check hypotheses from ongoing science experiments.
7. doing experiments based on content read.
8. reading from other reference sources to confirm or modify subject matter contained in the basal.
9. researching related data by using reputable sources of information.
10. engaging in a homework activity by identifying and solving a relevant problem.

Using a basal science textbook can truly become a good learning activity if pupils understand and can apply information obtained. Subject matter should make sense to the pupil and not be trivialized. The pupil needs to reflect upon its meaning, think critically and creatively about its contents, and make use of ideas to solve problems. Providing readiness for pupils prior to reading is time well spent for the science teacher. A relevant science curriculum will have as one of its learning opportunities the skill of reading; other kinds of materials to use in teaching- learning situations will include the semiconcrete and concrete means of learning. Reading stresses the use of abstract materials in the science curriculum. Additional abstract experiences include listening, speaking, and

writing. The latter three kinds of abstract learning activities need elaboration so that related reading skills might be increased for each learner.

Listening in the Science Curriculum

Listening well assists pupils to achieve more optimally since we learn much from listening to others. In small and large group discussions within a science unit, pupils should develop skill to grasp ideas readily. It might be that any spoken idea is said one time only. If a pupil did not secure the idea, he/she has not learned as much as possible. Then too, what one fails to secure as a result of listening may also hinder from obtaining other information due to its contextual setting. There are numerous purposes or reasons for quality listening in the science curriculum. Among others, these include listening to

1. a discussion of an ongoing science experiment such as problem selection, possible solutions to the problem, data gathering, and appraisal of the solutions offered previously.
2. an evaluation of ideas presented in a science demonstration. Content therein should be appraised and evaluated.
3. a book report on a relevant issue in science.
4. acquiring information from a committee project when elaborated upon by its members.
5. a creative or formal dramatization pertaining to the life and times of a scientist.
6. poetry written pertaining to an ongoing science unit.
7. showing and explaining a mural developed by volunteers in an ongoing science unit of study.
8. a cassette recording related to a lesson presentation.
9. a video- tape on a selected topic in science.
10. creative prose written by learners such as tall tales, myths, legends, and others, relating to interests of pupils in science.

To provide for individual differences, pupils need to experience a variety of activities in science. Each pupil needs to learn as much as

possible. Learners differ form each other in learning styles possessed. This means that different activities should be available for learner interaction.

Speaking Activities in Science

A variety of rich speaking experience should be available to pupils so that quality communication in science is achieved by each. The teacher needs to guide the concept of excellence in oral communication. Scientists tend to be strong in oral communication skills. Pupils too should be assisted to truly communicate well with others. What might pupils learn to communicate in science well so that effective interpersonal interaction is in evidence?

1. the development of and results of a science experiment.
2. the completed reading of ideas contained in a textbook, library book, journal, or other printed materials related directly to an ongoing science unit.
3. oral reports given pertaining to content read inherent in a lesson.
4. main ideas circulating within a committee setting.
5. brain storming to solve a problem within the class as a whole.
6. dramatic endeavors to communicate selected content to peers.
7. reader's theater to present specific subject matter to listeners.
8. purposes involved in planning, developing, and evaluating a project in science.
9. pupil demonstration and explanation of a phenomena being studied in science.
10. committee exploration of methods of solving an identified problem area in science.

The science teacher must have as a major goal in the science curriculum to assist pupils to be able to communicate well so that more optimal attainment for each learner is an end result.

Writing in Science

Writing can be a difficult skill to achieve when proficiency is

involved. Abstractions are stressed here such as symbols representing content in science. The symbols pertain to a code that must be broken to read and understand subject matter. When writing, the situation is reversed, the writer encodes so that a reader can ascertain the inherent ideas. The encoding with letters to represent words and larger units such as sentences, paragraphs, and entire selections must be accurate and complete. Vagueness and a lack of coherence must be eliminated in writing. What pupils learn in language arts can then be transferred to the area of writing in science. The following salient writing purposes need to be stressed in science:

1. the plan and results of a science experiment.
2. notes taken over content read from the basal text.
3. outlines written covering a relevant selection.
4. business letters written to order vital materials pertaining to a unit of study.
5. friendly letters written to pen pals to share ides about what is presently being studied.
6. diary entries written pertaining to subject matter acquired on successive days of learning.
7. log entries recording coverage of content covering a week or for the entire unit of study.
8. journal writing reflecting upon the learner's achievements for and in learning.
9. written book reports telling a few major ides acquired from reading.
10. a formal dramatization in which play parts are written for the life and times of a famous scientist.

A variety of writing activities should be in the offing so that pupil proficiency is developed when communicating ideas. Individual differences in writing achievement need to be considered by the science teacher. The pupil and teacher need to appraise what the former has attained previously in order to ascertain if improvement in writing has occurred in the preset completed sample of written work. A folder for each pupil's written work needs to be kept so that earlier written work

can be compared with later products to notice progress of the learner in writing for a variety of purposes.

In Conclusion

Reading of subject matter in science is a salient activity along with other kinds of experiences involving the concrete and the semiconcrete. The science teacher needs to be certain that pupils are ready for reading content prior to the actual reading activity. This is especially true of reading from the basal text. Thus the teacher should have pupils see and attach meaning to the new words in the text prior to reading. Learners also need adequate background information of what will be read, prior to reading. A reason or purpose for reading will increase reading comprehension. Thus pupils have a framework or questions to answer in reading for ideas, facts, concepts, and generalizations.

There should be a follow up of experiences after pupils have completed reading a given selection so that comprehension and retention of content is in evidence.

Complimenting the reading activity are listening, speaking, and writing activities. Divers kinds of activities are in evidence here to encourage pupils to communicate ideas clearly through speaking and writing, as well as acquire subject matter through reading and listening. Pupils individually need to achieve as much as possible in ongoing lessons and units of study in science.